

TEMPORARY CROSS-CLAMPING OF THE INFRARENAL ABDOMINAL AORTA DURING CESAREAN HYSTERECTOMY TO CONTROL OPERATIVE BLOOD LOSS IN PLACENTA PREVIA INCRETA/PERCRETA

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SUMMARY

Objective: To evaluate the efficacy and safety of temporary cross-clamping of the infrarenal abdominal aorta for controlling operative blood loss during cesarean hysterectomy in severe invasive placentation.

Case Report: A 35-year-old woman with a significant risk factor of four previous cesarean sections and placenta previa was referred to Taichung Veterans General Hospital with suspected abnormal placentation at 37 weeks of gestation. Obstetric ultrasonography and magnetic resonance imaging showed a bulky inhomogeneous placenta with extensive uterine serosa-bladder interface hypervascularity and suspicious focal bladder invasion. Cesarean hysterectomy was performed with the use of temporary cross-clamping of the infrarenal abdominal aorta. The duration of aortic cross-clamping was 1 hour, and the estimated blood loss was 2,000 mL. The patient was discharged home on postoperative day 11 with no postoperative sequelae.

Conclusion: With this limited experience, we are encouraged by the apparent reduction in operative blood loss after the use of temporary cross-clamping of the infrarenal abdominal aorta during cesarean hysterectomy. Further investigation is needed to determine the efficacy and safety of this procedure. [*Taiwan J Obstet Gynecol* 2010;49(1):72-76]

Key Words: aortic cross-clamping, blood loss, cesarean hysterectomy, placenta percreta

Introduction

Placenta accreta and its variants, increta/percreta, represent an important cause of massive peripartum hemorrhage and source of maternal morbidity and mortality

in modern obstetrics, accounting for 46% of cesarean hysterectomies (CH) performed [1].

Severe invasive placentation unexpectedly encountered at the time of delivery can lead to catastrophic consequences, such as uterine rupture, massive hemorrhage, and even maternal death. The use of ultrasonographic and magnetic resonance imaging [2-6] in the setting of conventional risk factors for invasive placentation (previous cesarean section, placenta previa) allows for accurate prenatal diagnosis and advanced preparation before delivery. This allows an experienced multidisciplinary team to be assembled in advance to



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manage the potential dreadful hemorrhagic complications by reducing potential operative blood loss.

Temporary cross-clamping of the infrarenal abdominal aorta (IAA) during CH to control operative blood loss in invasive placenta is a relatively innovative procedure, and it has seldom been described in obstetric literature [7–9]. To date, there is limited evidence as to the effectiveness and safety of this interventional procedure in the reduction of operative blood loss during CH. In this case report, we describe our preliminary experience of using temporary cross-clamping of the IAA for controlling operative blood loss during CH in severe invasive placenta.

Case Report

A 35-year-old woman, gravida 5, para 4, was referred to us at 37 weeks' gestation for cesarean delivery with suspected placenta accreta. The patient's four prior pregnancies were delivered by cesarean sections at term. Four-dimensional ultrasound showed a moth-eaten appearance of bulky placenta (11 cm in thickness) with multiple lacunae and disruption of the uterine serosa-bladder wall architecture (Figure 1). Color Doppler ultrasound revealed markedly increased uterine serosa-bladder interface hypervascularity with the aberrant vessels extending into the bladder (Figure 2). Preoperative cystogram demonstrated dilated tortuous vessels within bladder mucosa (Figure 3). A coronal T2-weighted magnetic resonance image showed characteristic features of invasive placenta which included lower uterine segment outward bulging, heterogeneous signal intensity within the bulky placenta,

dark intraplacental bands (flow voids), and tenting of the bladder with numerous tortuous flow voids representing markedly increased blood flow around the bladder (Figure 4).

The patient had been counseled regarding the risk of massive hemorrhage during CH. Interventional radiology had previously been consulted to discuss the use of common iliac artery balloon occlusion to minimize intraoperative blood loss. However, complications of popliteal artery and external iliac artery thrombosis were encountered in two recent consecutive cases affected with severe invasive placenta. Therefore, after detailed counseling, the patient chose to use a new procedure of temporary cross-clamping of the IAA during CH for controlling operative blood loss. A repeat cesarean delivery was performed under general anesthesia, and a viable male infant weighing 3,080 g, with Apgar scores of 6 and 9 at 1 and 5 minutes, respectively,

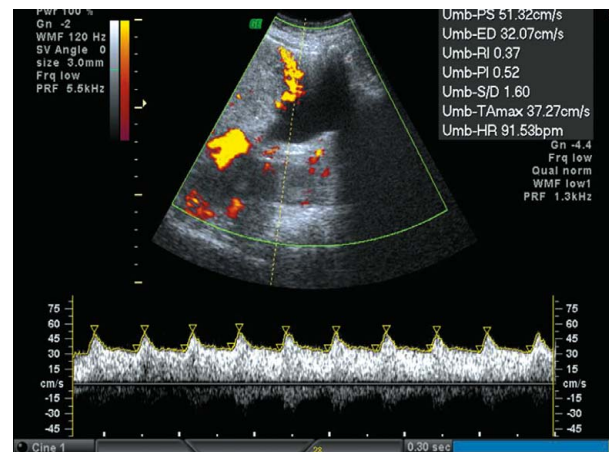


Figure 2. Sagittal transabdominal color Doppler ultrasound image showing uterine serosa-bladder interface hypervascularity with low-resistant (resistance index, 0.37), neovascularized arterial flow extending into the bladder.



Figure 1. Four-dimensional ultrasound showing a moth-eaten appearance of bulky placenta with irregularity and disruption of the uterine serosa-bladder wall architecture. Note the multiple lacunae within the bulky placenta (11 cm in thickness). B=bladder; L=lacunae; P=placenta.



Figure 3. Preoperative cystogram demonstrating dilated tortuous vessels within the bladder mucosa.

was delivered through a fundal hysterotomy incision. After the fetus was extracted, the abnormally adherent placenta was left *in situ*, and hysterotomy wound was rapidly closed. Retroperitoneal dissection was

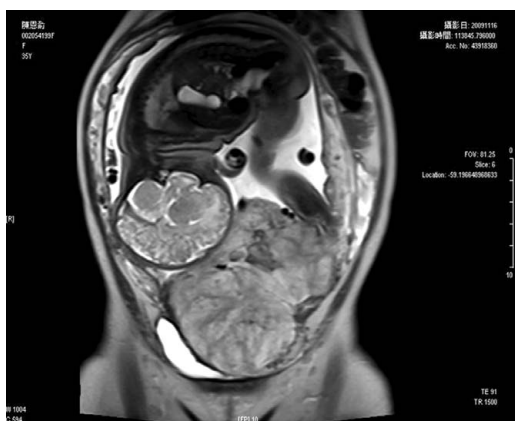


Figure 4. Coronal T2-weighted magnetic resonance image showing outward bulging of the lower uterine segment and heterogeneous signal intensity and dark intraplacental bands (flow voids) within the bulky placenta. Extrinsic compression of the bladder with suspicious focal invasion is also seen along its superior margin.

performed to separate the IAA from the inferior vena cava between the fourth lumbar and aortic bifurcation, and the IAA was then suspended with a nylon yellow tape (Figure 5). This crucial maneuver should be performed before the aortic clamp is placed. After an administration of a total of 5,000 units of intravenous heparin for thromboprophylaxis, the aorta was cross-clamped with the use of the Cosgrove Flex Clamp (V. Mueller, Allegiance Healthcare Corp., IL, USA; Figure 5). This clamp is flexible, is used for atraumatic vascular occlusion, and can be easily moved. Dissection proceeds between both round ligaments to allow an uneventful parametric approach. Newly formed vessels between the bladder and abnormally adherent placenta were identified and meticulously ligated to appropriately separate the bladder from the densely adherent lower uterine segment. Supracervical uterine resection was performed, and the cervical vault was repaired. During the surgical procedure, pulse oximetry was established to monitor the arterial oxygen saturation of both feet. In addition, temperature, pedal arterial pulsation and segmental lower limb blood pressure were regularly checked to monitor any potential ischemic or

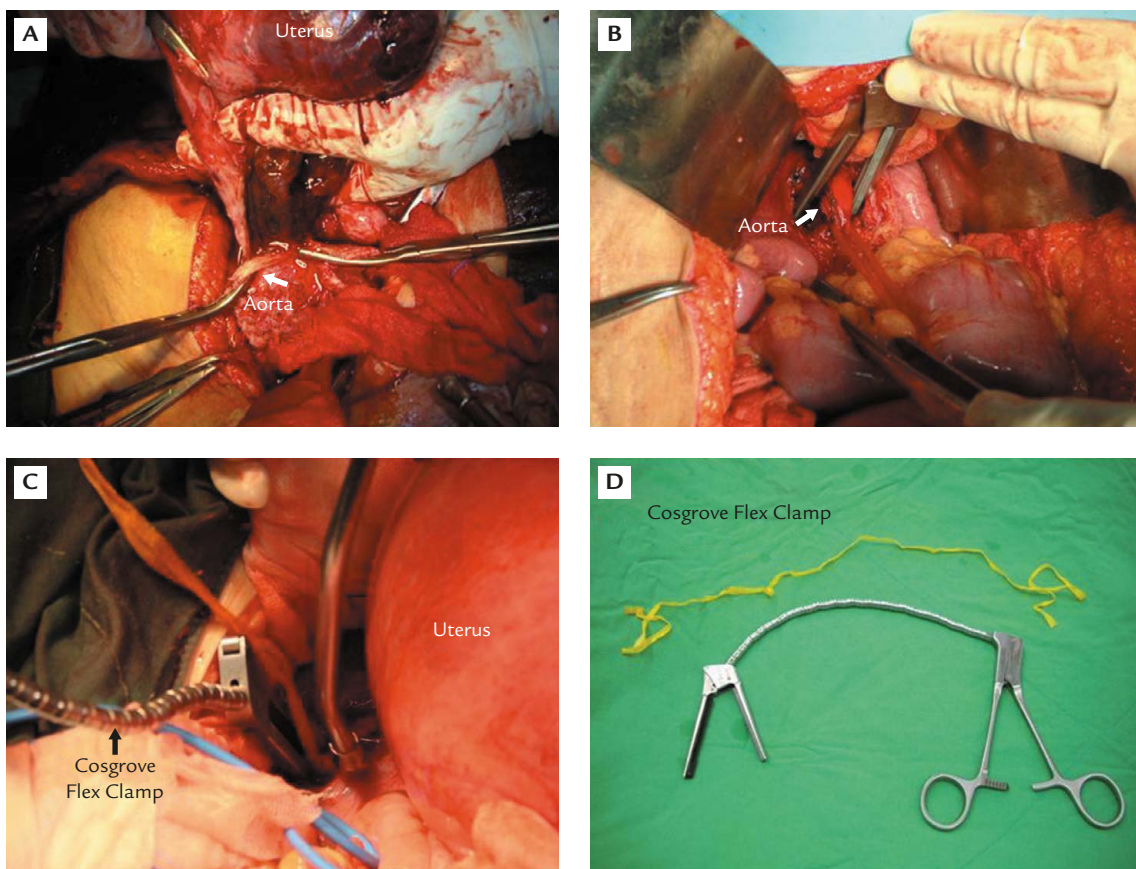


Figure 5. (A-D) Operative photographs show that retroperitoneal dissection was performed to separate the infrarenal abdominal aorta from the inferior vena cava between the fourth lumbar and aortic bifurcation. The infrarenal abdominal aorta was then suspended with yellow tape and was cross-clamped with the use of a Cosgrove Flex Clamp (V. Mueller, Allegiance Healthcare Corp., IL, USA).

thrombotic injury of lower limbs. The duration of aortic cross-clamping was 1 hour, and the estimated blood loss was 2,000 mL, which was lower than our anticipated blood loss of > 7,500 mL, judging from our past surgical experience in cases with similar levels of severity. The patient was discharged on postoperative day 11 with no postoperative sequelae.

Discussion

Three techniques had been reported in the literature for proximal vascular control of extensive uteroplacental and pelvic collateral circulation encountered in severe invasive placentation [7–11]. In 1995, Paul et al [10] described the placement of an 18-mm occlusion balloon in the IAA in a patient with placenta percreta before CH with subsequent deflation after closure of the vaginal vault. Temporary balloon occlusion of the common iliac arteries during CH was described in one case in 2005 by Shih et al [11]. In 2006 and 2007, Sewell et al [12] and Greenberg et al [13] reported two cases in which the pregnant mothers affected with placenta accreta, who underwent prophylactic common and internal iliac balloon catheterization, experienced severe complications of popliteal artery and iliac artery thrombosis, respectively.

Shrivastava et al [14] reported a large case-control study of 69 subjects that had CH performed for placenta accreta. Nineteen subjects with preoperative internal iliac artery balloon catheter (BC) placement plus hysterectomy were compared with 50 subjects who had undergone hysterectomy alone. No significant differences were noted in estimated blood loss. Importantly, three of the 19 BC subjects (15.8%) had severe complications from catheter placement; one patient was noted to have an internal iliac artery thrombosis and groin hematoma. A second patient had an internal iliac artery dissection with 80–90% occlusion. A third patient had a femoral artery thrombosis. Shrivastava et al [14] concluded that prophylactic intravascular BC did not benefit women with placenta accreta undergoing CH. Failure of occlusive balloons to reduce blood loss from CH may be explained by the degree of markedly increased uteroplacental blood flow in invasive placentation and the extensive vascular collateral anastomosis present in the gravid pelvis. Given these facts, the use of preoperative internal iliac artery BC for placenta accreta is not recommended. Therefore, the utility of intraarterial balloon catheterization for the prevention of obstetric hemorrhage in cases of abnormal placentation remains unclear. Special care must be taken owing to the hypercoagulable state of pregnancy to decrease

the possibility of thromboembolic events, and be prepared to care for these events should they occur.

Palacios Jaraquemada [7,8] described using the innovative approach of infrarenal aortic looping for conservative surgery of anterior placenta percreta to reduce obstetric hemorrhage. According to the literature, the duration of aortic cross-clamping can be at least 1 hour in surgery for abdominal aortic aneurysm. After an ischemic period of 1–2 hours during aortic aneurysm surgery, the redox status of the most important endogenous free radical scavenger, muscle glutathione, is not altered, indicating that this ischemic insult is well within the scavenging capacity of muscle glutathione [15]. Wahlberg et al [16] reported that if suprarenal clamp duration (renal ischemia time) is brief, patients with normal preoperative creatinine levels exhibit no increase or a marginal increase in blood urea nitrogen or creatinine levels after surgery. Accordingly, less than 50 minutes of suprarenal aortic clamping appears safe and well tolerated. Although theoretically, infrarenal aortic clamping is much safer than suprarenal aortic clamping, we recommend that the shortest possible occlusion time should be less than 60 minutes.

With this limited experience, we are encouraged by the apparent reduction in operative blood loss with the use of temporary cross-clamping of the IAA during CH. Further investigation in a large case series is needed to determine the efficacy and safety of this procedure.

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References

1. Flood KM, Said S, Geary M, Robson M, Fitzpatrick C, Malone FD. Changing trends in peripartum hysterectomy over the last 4 decades. *Am J Obstet Gynecol* 2009;200:632.e1–6.
2. Finberg HJ, Williams JW. Placenta accreta: prospective sonographic diagnosis in patients with placenta previa and prior cesarean section. *J Ultrasound Med* 1992;11:333–43.
3. Chou MM, Tseng JJ, Ho ESC, Hwang JI. Three-dimensional color power Doppler imaging in the assessment of uteroplacental neovascularization in placenta previa increta-percreta. *Am J Obstet Gynecol* 2001;185:1257–60.
4. Chou MM, Ho ESC, Lee YH. Prenatal diagnosis of placenta previa accreta by transabdominal color Doppler ultrasound. *Ultrasound Obstet Gynecol* 2000;15:28–35.
5. Chou MM, Chen WC, Tseng JJ, Chen YF, Yeh TT, Ho ESC. Prenatal detection of bladder wall involvement in invasive placentation with sequential two-dimensional and adjunctive

- three-dimensional ultrasonography. *Taiwan J Obstet Gynecol* 2009;48:38–45.
6. Baughman WC, Corteville JE, Shah RR. Placenta accreta: spectrum of US and MR imaging findings. *Radiographics* 2008;28:1905–16.
 7. Palacios Jaraquemada JM. Ultrasound interactive case study: conservative treatment in placenta accreta and percreta. Available at: <http://www.obgyn.net/ultrasound/ultrasound.asp?page=/us/present/0107/jaraquemada> [Date accessed: December 3, 2009]
 8. Palacios Jaraquemada JM. Aortic cross-clamping in obstetrics. Available at: http://www.obgyn.net/displayarticle.asp?page=/english/pubs/features/POV-aortic_cross [Date accessed: December 3, 2009]
 9. Kamani AA, Gambling DR, Christilaw J, Flanagan ML. Anaesthetic management of patients with placenta accreta. *Can J Anaesth* 1987;34:613–7.
 10. Paul JD, Smith J, Williams L, Davison G, Devine T, Holt M. Balloon occlusion of the abdominal aorta during cesarean hysterectomy for placenta percreta. *Anaesth Intensive Care* 1995;23:731–4.
 11. Shih JC, Liu KL, Shyu MK. Temporary balloon occlusion of the common iliac artery: new approach to bleeding control during cesarean hysterectomy for placenta percreta. *Am J Obstet Gynecol* 2005;193:1756–8.
 12. Sewell MF, Rosenblum D, Ehrenberg H. Arterial embolus during common iliac balloon catheterization at cesarean hysterectomy. *Obstet Gynecol* 2006;108:746–8.
 13. Greenberg JL, Suliman A, Iranpour P, Angle N. Prophylactic balloon occlusion of the internal iliac arteries to treat abnormal placentation: a cautionary case. *Am J Obstet Gynecol* 2007;197:470.e1–4.
 14. Shrivastava V, Nageotte M, Major C, Haydon M, Wing D. Case-control comparison of cesarean hysterectomy with and without prophylactic placement of intravascular balloon catheters for placenta accreta. *Am J Obstet Gynecol* 2007;197:402.e1–5.
 15. Westman B, Johansson G, Soderlund K, Wernerman J, Hammarqvist F. Muscle glutathione metabolism during ischemia and reperfusion in patients undergoing aorto-bifemoral bypass surgery. *Acta Anaesthesiol Scand* 2006;50:699–705.
 16. Wahlberg E, Dimuzio PJ, Stoney RJ. Aortic clamping during elective operations for infrarenal disease: the influence of clamping time on renal function. *J Vasc Surg* 2002;36:13–8.